CHAPTER - V
FINDINGS, CONCLUSION AND RECOMMENDATIONS

Assessments of motor variables have been in practice in most of the reported literature in the field of physical education. The modern day growth of the field provides ample opportunities for the overall development of an individual. In the present context, motor fitness is one of the potential characteristics of an individual. It is very difficult to specify one’s physical fitness accurately on the basis of numerical data, yet through observations and studies into physical attributes and involvement of muscles, it is not possible to assess one’s physical fitness objectively enough.

The purpose of this study was to construct a specific fitness test battery for school girl’s hockey players and to standardize the motor fitness of school girl’s hockey players.

Since, the study needed an elaborate investigation; it was divided into two phases.

First phase of study

The collected data in the pilot study of 30 girls hockey players between the age of 13 to 15 years of Haryana. The co-efficient correlation between all 35 tests of seven components was made by the statistical technique. Similarly reliability of all 35 factors also searched through the reliability statistical technique. Reliability is usually measured in terms of correlation co-efficient between the first and second measure.
The higher the correlation, the more similar the measurements are and therefore the greater is the test-retest reliability.

Initially, 19 test items were selected in consultation with experts, on the basis of pilot study work. Face validity was the criterion considered in selecting the test items. Weight and height were considered to be general factors. All test variables were selected in order to administer on school girls hockey players who had participated at District, State and National level tournaments.

Selected test items were administered to a representative sample of 180 school girls’ hockey players. Proper motivational measures had been taken to ensure the best performance by students on test items. Objectivity of test items was obtained by administering the test by two testers on the same sample, on the same day and during two different sessions. The reliability of test items was obtained by the test-retest method.

Correlation matrix was obtained for 19 variables. Principal components analysis method was used to extract factors, which generated four factors. These four factors accounted for 87.71 per cent of the total variance in the data set. These factors individually possess 35.63, 27.13, 17.79, 7.63 per cent of the total variance.

The factors identified were muscular Strength, Agility, Endurance, Speed, Flexibility, Power, Co-ordination respectively. These sub-systems are components of major system called specific physical fitness.
STATISTICAL TREATMENT

Factor analysis was done for construction of specific fitness test battery for girl’s hockey players by following three steps:

i) First step Correlation matrix
ii) Second step Eigen Values, Extraction Sums of Squared Loadings and Rotation Sums of Squared Loadings.
iii) Third step Rotated Factor Loading.

A test battery was constructed after selecting one most reliable and valid test for each fitness variable such as Speed, Strength, Endurance, Agility, Flexibility, Power and Co-ordination. The details of all the seven factors are presented as follows:

AGILITY

In this variable, Agility Test -I have the highest loading of (.966) and Agility Test – II and Agility Cycle came out with the loading of (.956) and (.952) and the loading is higher than the 0.512. The level was cited by Andy field. But only “Agility Test – I” was selected for including in the specific physical fitness test battery, because this test item has the highest loading than other items. Other motor fitness test variables came out low loading with Agility. It has shown close association with the Speed variable and a negative relationship with the muscular Strength factor.

SPEED

In Speed variable, 40 Meter Run have the highest loading of (.941) and all Speed factors, 50 Meter Run and 60 Meter Run came out with (.930) and (.917) respectively were higher than the 0.512. But only the “40
**Meter Run** was selected for including in the highest loading item than other items. Other motor fitness test variables as muscular strength and endurance shows very low and negative loading as Shot Put (-0.017), Basketball Throw (-0.056) and 800 Meter Run (-0.035) with Speed variable. This data explain that both the activity with rate of change of body directions and the activity with a series of faster body movements (Speed) go hand in hand. More agile persons will usually possess greater speed.

**FLEXIBILITY**

In Flexibility variable, Bend Twist Touch test have the highest loading of 0.968 and Sit and Reach test came out with 0.928 loadings. Flexibility test have shown close association with co-ordination and low loading with other variables but some of the Strength, Endurance and Power variables came out with very low loading as Push-Up (0.003), 800 Meter Run test (0.072) and Vertical Jump (0.052). But only “**Bend Twist Touch**” was selected for the inclusion in the motor fitness test battery, because this was the highest loading item than other items.

**CO-ORDINATION**

Rotated factor analysis shows that, in Co-ordination variable, Alternative Hand Wall Toss have the highest loading of 0.940 and Reaction Speed Test have the loading of 0.897 respectively, were higher than 0.512 of an alpha level of 0.05. But only “**Alternative Hand Wall Toss**” was selected for the inclusion in the fitness test battery, because this test was the highest loading item than other items.
**STRENGTH**

In Strength variable, Push-Up test have the highest loading of .978 and other strength variables, Basketball Throw and Shot Put came out with .954 and .853 loadings and respectively, were higher than 0.512. But only “Push Up” was selected for including in the fitness test battery, because this item was the highest loading item than other items. All tests of Strength and Power have shown significant loadings, but some of the Speed, Endurance, Flexibility and Co-ordination variables shows very low loadings with Strength variable as 60 Meters Run (.023), 50 Meter Run (.032), 800 Meter Run (-.023), Bend Twist Touch (.033) and Reaction Speed Test with the loading of (-.011).

**POWER**

In Power, Vertical Jump test have the highest loading of (.936) and other power variables, Over Hand Medicine Ball Throw and Standing Broad Jump came out with the loadings of (.928) and (.900) respectively, were higher than 0.512. But only “Vertical Jump” was selected for including in the test battery, because this item was the highest loading item than other items. All tests of power and strength have shown significant loading and other motor fitness test variables came out low loading, but the Speed factor have shown very low loading with Power.

**ENDURANCE**

In Endurance variable, 800 Meter Run have the loading of .883 and 2.4 Kilo Meter Run (.637) and 600 Meter Run/ Walk ( .691) were higher than the 0.512. But only “800 Meter Run” was selected for including in
the physical fitness test battery, because this test item was the highest loading item than other items and other fitness variables came out with lower loading. But all the variables of power and two variables of Strength and one from Flexibility variable have shown very low loading with endurance.

**Phase II of the Study**

For standardization of specific test battery ANOVA and t-test were applied by the researcher. ANOVA was applied on 180 girl’s hockey players on prediction factors, age, weight and height. And comparison validity was established by comparison of specific fitness battery between successful and unsuccessful players.

In Agility by using ANOVA on Agility Test-I, it was found significant at 0.05 level. So it shows best results at the age of 13 years with weight between 41 kg to 45 kg and height upto 144 cms to 155 cms. And after applying t-test between 25 successful and 25 unsuccessful girls hockey players, Agility Test-I mean score of 11.84 and 13.84 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 4.94, which is significant at 0.05 level. It indicates that there is significant difference in Agility test- I among successful and unsuccessful girls hockey players

In Speed by putting ANOVA on 40 Meter Run test was found significant at 0.05 level. So it shows best results at the age of 13 years with weight between 41 kg to 45 kg and height between 144 to 155 cms. And 40 Mts Run test between successful and unsuccessful girls hockey
players found with mean score of 6.77 and 7.34 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 3.451, which is significant at 0.05 level. It indicates that there is significant difference on 40 Mts Run among successful and unsuccessful girls hockey players.

In Flexibility after applying ANOVA on Bend Twist Touch, prediction factors age and weight are not significant at 0.05. It shows that Bend Twist Touch is significant for all ages and all weights and its best for height upto 144 cms. Bend Twist Touch test between successful and unsuccessful girls hockey players found to have mean score of 19.64 and 15.16 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 36.33, which is significant at 0.05 level. It indicates that there is significant difference on Bend Twist Touch test among successful and unsuccessful girls hockey players.

In Co-ordination by using ANOVA on Alternative Hand Wall Toss, age factor is significant at 0.05 level. It shows Alternative Hand Wall Toss test is good for the age of 13 years and weight and height are not significant at 0.05 with Alternative Hand Wall Toss test, it shows that Alternative Hand Wall Toss test is good for all weights and all heights. Alternative hand wall toss test between successful and unsuccessful girls hockey players found to have mean score of 24.56 and 15.84 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 20.04, which is significant at 0.05 level. It indicates that there is significant difference on Alternative Hand Wall Toss among successful and unsuccessful girls hockey players.
In Strength, there is no significant difference with age after applying ANOVA on Push Up, it shows that Push-Up is significant for all ages i.e 13 years, 14 years and 15 years and Push-Up test shows best results with weight above 45kg and height above 155 cms. Push-Up test between successful and unsuccessful girls hockey players found to have mean score of 19.00 and 15.12 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 8.135, which is significant at 0.05 level. It indicates that there is significant difference on Push-Up test among successful and unsuccessful girl’s hockey players.

In Power by using ANOVA on Vertical Jump, age factor is not significant at 0.05, it shows that Vertical Jump test is significant for all ages and weight and height shows best results with weight between 41 to 45 kg and height above 155 cms. Vertical Jump test between successful and unsuccessful girls hockey players found to have mean score of 27.12 and 21.36 respectively. The ‘t’ ratio between the mean score of these two different groups came out to be 8.45, which is significant at 0.05 level. It indicates that there is significant difference on Vertical Jump test among successful and unsuccessful girls hockey players.

In Endurance by using ANOVA on 800 Meter Run test, there is no significant difference with age, it shows that 800 Meter Run is significant for all ages i.e 13 years, 14 years and 15 years and 800 Mts Run test shows best results with weight upto 40kg and height upto 144 cms. 800 Mts Run test between successful and unsuccessful girls hockey players found to have mean score of 3.27 and 3.88 respectively. The ‘t’
ratio between the mean score of these two different groups came out to be 8.48, which is significant at 0.05 level. It indicates that there is significant difference on 800 Mts Run among successful and unsuccessful girls hockey players.

DISCUSSION OF FINDINGS

- It was evident from the findings of the study that overall seven variables that have high loadings were selected out of 19 test variables.

- In Speed variable, 40 Mts Run have highest loading of .941, in Strength variable, Push-Up have highest loading of .978, in Endurance variable, 800 Meter Run have highest loading of .883, in Agility variable, Agility Test-I have highest loading of .966, in Flexibility variable, in Bend Twist Touch have highest loading of .968, in Power variable, Vertical Jump have highest loading of .936 and in Co-ordination variable, Alternative Hand Wall Toss have highest loading of .940.

- **ANOVA** test was used to find whether the selected test battery was significant with prediction factors age, weight and height. And in result she find that some of motor fitness components are highly significant at specific age, weight and height and other were highly significant in all the three prediction factors i.e age, weight and height

- **COMPARISON VALIDITY** Comparison validity was established by the comparison of motor fitness test battery between successful and unsuccessful players. Successful players were the players who were selected to the National and unselected
players were selected randomly from the players who participated in district and state tournaments. The ‘t’ value between successful and unsuccessful players were highly significant.

CONCLUSION

Within the limits and limitations of the present study, the following conclusions are enumerated:

- The factor analysis yielded seven specific fitness tests.
- The battery of tests developed by the researcher has the ability to predict the specific fitness of hockey players.
- All the seven tests showed significant relationship with the hockey playing ability.
- The relationship between composite score of all the test items and playing ability was also significant.
- The newly developed fitness tests meet the criterion of scientific authenticity i.e the test items are reliable, objective and valid.

RECOMMENDATIONS

- The test constructed will serve as a valid tool for assessing high school girl’s physical fitness in India and therefore the physical education teachers can make use of the test to evaluate student performance.
- The test can be used by the coaches/selectors to know the physical capacity of the player while selecting potential competitors.
- Rating of seven components of specific fitness will be possible and accordingly the training programmes could be rescheduled.
• Similar type of studies can be done on elementary school children, high school boys, college men and women.

• Many factor analytic studies could be conducted in India pertinent to specific components of motor fitness, so that a generalized conclusion can be drawn with respect to motor fitness. Furthermore, these types of studies will lead to plan for experimental designs in measurement area.

• Other multivariate analyses like cluster analysis, discriminate analysis etc. could be used to decipher the behavior of numerical data with respect to specific fitness.

• As the age factor did not yield significant results it warrants a detailed study. Other area like speed, body co-ordination, flexibility etc. should also be thought of for further studies.

• Normative studies can be done on the constructed physical fitness test throughout India.

• Regional importance should be given to identify and underhand better the physical capacity of Indian youth and such studies should lead to improve the physical fitness standard of our Indian Youth.